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# **02-T1: Clustering of learning outcomes into UPWOOD learning units**

UPWOOD

Up-skilling construction workers in wood construction  
methods for energy efficient buildings



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## 1. Acronyms and Abbreviations

UPWOOD	Up-skilling construction workers in wood construction methods for energy efficient buildings
WBL	Work-Based-Learning
LU	Learning Unit
ECVET	European Credit system for Vocational Education and Training
EQF	European Qualification Framework
EU	European Union
EWP	Engineered Wood Products
VET	Vocational Education and Training
GLT	Glued Laminated Timber
CLT	Cross-laminated timber

<b>UPWOOD Consortium</b>	
<b>HCS</b>	Holzcluster Steiermark GmbH
<b>EXELIA</b>	EXELIA E.E.
<b>UPV</b>	Universitat Politecnica de Valencia
<b>LVT</b>	PIKC "Liepajas Valsts tehnikums"
<b>WOODPOLIS</b>	Kuhmon Kaupunki



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## 2. Introduction

The first task of the UPWOOD project Intellectual output 2 anticipates to develop the WBL curriculum structure by elaborating learning units out of the previously defined learning outcomes (O1-T4). Additionally, the task includes development of specifications for each learning unit to address pedagogical orientations.

In order to group the learning outcomes into learning units, there need to be identified the outcomes that relate to each other following the criteria from the project application form:

- a) relevance to the same set of occupational tasks,
- b) relevance to specific stage in the process of performing a task,
- c) relevance to the same area of skills.

After the curriculum is created and validated by the consortium, the bulk of learning materials will be elaborated for each learning unit (O2-T2), continuing with development of trainer handbook with WBL guidelines for VET providers and construction sector employers (O2-T3).



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### 3. The UPWOOD curriculum structure

According to the ECVET guide, published by the European Commission, a unit is a component of a qualification, consisting of a coherent set of knowledge, skills and competence, which can be assessed and validated. Units enable progressive achievement of qualifications through transfer and accumulation of learning outcomes. [1]

Based on the findings of the research and survey carried in frame of the Intellectual output 1, themes of the learning units proposed in the application form have been modified in order to manage grouping of the defined learning outcomes.

Table 1 demonstrates the allocation of the defined UPWOOD learning outcomes between the proposed learning units.

*Table 1. The UPWOOD learning outcomes clustered into units*

<b>LU1: Qualities of wood &amp; its various applications in construction</b>	LO1 Develop knowledge and understanding of the different types of wood and their properties.
	LO2 Give an account of the limitations that wood presents as a building material in a given situation.
	LO5 Autonomously select the most appropriate type of wood or wood building product (e.g. CLT) according to construction project requirements.



<p><b>LU2: Timber construction, renovation and deconstruction</b></p>	<p>LO6 Demonstrate the skills to work with prefabricated wooden building products.</p>
	<p>LO7 Autonomously select the appropriate wooden structure.</p>
	<p>LO8 Assess the use of wood in renovation, extension or deconstruction projects.</p>
	<p>LO5 Autonomously select the most appropriate type of wood or wood building product (e.g. CLT) according to construction project requirements.</p>
<p><b>LU3: On-site wood construction assembling management</b></p>	<p>LO9 Be able to organize/prioritize tasks and collaborate with team members.</p>
	<p>LO10 Understand fire/sound protection and building physics in the construction process.</p>
<p><b>LU4: Functionality and efficiency of wooden buildings</b></p>	<p>LO3 Understand the benefits of using wood in the active and passive design of a building in terms of energy efficiency.</p>
	<p>LO4 Evaluation of the climate influence in wooden buildings in order to reduce energy consumption.</p>



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	<p>LO11 Be able to integrate technical building components in timber construction.</p>
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## 4. Specifications of the UPWOOD learning units

The specifications of the UPWOOD learning units have been created following the criteria set up by the European ECVET network and using the template presented in the previous task (O1-T4). The comprehensive template for each unit comprises: a title, the list of topics of the learning unit content, learning objectives, prerequisites, learning materials, planned duration of the learning unit and references.

The developed units correspond to the EQF Level 4-5, which anticipate following requirements accordingly [2]:

### a) Level 4:

- factual and theoretical knowledge in broad contexts within a field of work or study,
- a range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study.
- exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change,
- supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities,

### b) Level 5:

- comprehensive, specialized, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge,
- a comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems,



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- exercise management and supervision in contexts of work or study activities where there is unpredictable change,
- review and develop performance of self and others.

The respective learning materials for each unit will be elaborated with regards to the above.

Table 2. Learning unit 1 specifications

Learning unit title		
Qualities of wood and its various applications in construction / Learning unit 1 (LU1)		
<b>Abstract</b>		
<p>Wood has lot of positive qualities. That is why it can be used for multiple purposes – furniture, pallets, food product storage, structural elements for construction etc. An example of the advantages of wood – specific gravity (strength relationship with density) compared to other building materials, is much higher. Wood and wood materials in construction are used widely and for sure amount of it will increase for the next years. Wood is expected construction material and therefore, it is used not only in residential construction, but also more and more for public construction facility development. At the time of exploitation timber construction elements which are used in direct 2nd and 3rd service class (accordance to Eurocode 5) must be subjected to timber preservation against degradation by physical and biological agents, time after time timber construction element maintenance should be done, covered using conventional last coating and treatment products or organic last coating and treatment products.</p> <p><b>Objective</b> U1 aims to enhance learners’ knowledge of different wood species properties, wood structure, increase biological durability by the chemical process technology point of view, wood - chemical, biological, physical modification technology, wood and its components, the new generation of self-binding protection products for wood and wood materials, impregnation materials and technology and other wood deep processing processes and perspectives.</p>		
<b>European Qualifications Framework (EQF) Level</b>		
Level 4		
<b>Learning Objectives</b>		
<p><b>Knowledge</b></p> <p><b>Knows/Aware of:</b></p> <ul style="list-style-type: none"> <li>• the different types of wood and their properties.</li> <li>• the limitations that wood presents as a building material in a given situation.</li> </ul>	<p><b>Skills</b></p> <p><b>Able to:</b></p> <ul style="list-style-type: none"> <li>• Choose the best wood species for constructive operational technology in building constructions.</li> <li>• Apply knowledge of the chemical timber deep processing of existing</li> </ul>	<p><b>Competence</b></p> <p><b>Capable to:</b></p> <ul style="list-style-type: none"> <li>• Autonomously select the most appropriate <u>type of wood</u> or wood building product according to construction project requirements.</li> </ul>



<ul style="list-style-type: none"> <li>the type of wood used in chemical processing technologies and their impact on the economy, ecology, as well as its promising future directions.</li> </ul>	<p>processes and the implementation of a new implementation, as well as to see the potential for innovation.</p>	<ul style="list-style-type: none"> <li>Access, select, analyze and summarize information on the chemical wood processing technologies and their potential positive and negative impacts on the environment and the economy, as well as competence to explain the chemical wood processing development needs of professionals and their use impact other stakeholders or customers.</li> </ul>
<p><b>Topics / Content</b></p>		
<p>This LU is comprised of the following parts:</p> <ul style="list-style-type: none"> <li>Wood properties (physical-mechanical, technological, operational, etc.), its limitations and wood construction physics.</li> <li>Possibilities of improving the properties of the wood and wood protection, durability.</li> <li>Availability and environmental friendliness of wood as a building material.</li> </ul>		
<p><b>Target group</b></p>		
<p>Unskilled construction workers who never worked with wood – this learning unit has a basic level and can be also used by companies outside the “construction site” sector – especially wood industry.</p>		
<p><b>Prerequisites / recommended background</b></p>		
<p>Vocational education, basic knowledge about construction sector.</p>		
<p><b>Teaching and assessment materials/methods</b></p>		
<p>Teaching material:</p> <ul style="list-style-type: none"> <li>40 pages with lecture notes and theory (~15 pages per topic).</li> <li>3 presentations, one per each topic (5...10 slides each presentation).</li> <li>Case studies: 15.</li> <li>FAQs: 25.</li> </ul> <p>Assessment material:</p> <ul style="list-style-type: none"> <li>Multiple choice questions: 25.</li> <li>Case studies and application scenarios analysis: 2.</li> </ul> <p>All learning materials will be available in English and in the partnership languages (German, Latvian, Greek, Spanish and Finnish).</p>		
<p><b>Planned duration of the learning unit</b></p>		
<ul style="list-style-type: none"> <li>Average duration for reading the lecture notes and slide presentations: 8h</li> <li>Learner personal work: 8h</li> </ul>		
<p><b>References</b></p> <ol style="list-style-type: none"> <li>Hill C.A.S. Wood Modification. Chichester: John Wiley &amp; Sons, Ltd, 2006. 239 p.</li> <li>Hoadley R.B. Understanding Wood: A Craftsman's Guide to Wood Technology. The Taunton Press, 2000. 288 p.</li> </ol>		



3. Niemz P. and Sonderegger W. U. Holzphysik: Physik des Holzes und der Holzwerkstoffe. Carl Hanser Verlag GmbH & Co. 2017., 580 p.
4. Rowell R.M. Handbook of wood chemistry and wood composites. London : Taylor&Francis group, London, 2005. 487 p.
5. Wagenführ A. Scholz F. Taschenbuch der Holztechnik. Carl Hanser Verlag GmbH & Co. 2018., 567 p.
6. Accoya acetylated wood <https://www.accoya.com/uk/>
7. Brookhuis wood measuring equipment <https://www.brookhuis.com/>
8. Osmose wood protection  
<https://www.koppersperformancechemicals.com/company/history.html>
9. Stora Enso Thermowood <https://www.storaenso.com/en/products/wood-products/cladding-and-decking/thermowood>
10. Swedish wood protection <https://www.swedishwood.com/wood-facts/about-wood/wood-protection/>
11. Tricoya acetylated MDF <https://tricoya.com/>
12. <https://lignumdata.ch/?lang=en>
13. Taschenbuch Holzbau Schweiz
14. <https://www.dataholz.eu/>
15. [www.infoholz.at](http://www.infoholz.at)

#### Notes

Table 3. Learning unit 2 specifications

Learning unit title
Timber construction, renovation and deconstruction / Learning unit 2 (LU2)
<b>Abstract</b>
<p>The advantage of wood is its simple processability and applicability of various wooden constructions. Some of such structures are furniture elements, bearing elements of structures, self-supporting element of the construction. This LU examines the above-mentioned structural timber application types, the establishment of the basic principles, as well as usability. Wood composites and engineered wood products are modern technologies of the forest industry sector. It combines the best that can provide wood and enhances its properties that are considered to be weaknesses of wood material. For construction joinery products weak spots of the external envelope are important such as connections: link millwork / window frame; link wall / window frame; link between cladding elements; ground-end of the cladding; passing elements through the cladding (electricity etc.). Most popular timber elements for buildings are cladding materials and following timber elements: slat cladding; clap board cladding; panel cladding; coating cladding; other cladding materials. Of course this is traditional way how to use wood for structures. Now day's development of energy less and material less materials for building elements in wood processing are produced. It means create special products, also for constructions sector, with increased specific properties. Despite it means reduction of some other initial properties, it is still various. And wood always is very good material for restoration, reconstruction and dismantling for the different wooden elements, in case it is needed, it could be used for constructions as recycled wood for one more life time.</p> <p><b>Objective</b> of this LU2 to gain knowledge about wood materials classification, nomenclature and types, terminology, wood materials sizes and volume determination, wood humidity and its influence, wood defects, processing defects</p>



and their influence to the wood material quality, wood materials quality evaluation, standardization and conformity checking as well as different type of modern wooden structural materials, their connectivity with different types of connectors, adhesives etc. One big part related to understand how to make wooden structural element restoration, reconstruction and dismantling of wooden building elements.

**European Qualifications Framework (EQF) Level**

Level 4

**Learning Objectives**

<b><u>Knowledge</u></b>	<b><u>Skills</u></b>	<b><u>Competences</u></b>
<p><b><u>Knows/Aware of:</u></b></p> <ul style="list-style-type: none"> <li>the use of wood in renovation, extension or deconstruction projects.</li> <li>the timber structural and non-load bearing construction elements it uses.</li> <li>wood as a construction material advantages and disadvantages.</li> </ul>	<p><b><u>Able to:</u></b></p> <ul style="list-style-type: none"> <li>work with prefabricated wooden building products.</li> <li>Work with various wood products and product design.</li> </ul>	<p><b><u>Capable to:</u></b></p> <ul style="list-style-type: none"> <li>Autonomously select the most appropriate type of wood or wood building product according to construction project requirements.</li> <li>Autonomously select the appropriate wooden structure.</li> <li>find the best ecological and economically advantageous design of wood product design and performance options.</li> </ul>

**Topics / Content**

- Performance and durability of wooden structures.
- Guidelines on work with sawn materials, wood-based panel and engineered wood products (EWP).
- Guidelines on work with Glued Laminated Timber (GLT) and Cross Laminated Timber (CLT).
- Guidelines on work with different construction products (windows, doors, etc.).
- Use of connectors and adhesives.
- Restoration, reconstruction and dismantling of wooden elements.
- Wooden trusses.

**Target group**

Skilled workers of construction site, but not educated in timber construction

**Prerequisites / recommended background**

UPWOOD Learning unit 1 - Qualities of wood and its various applications in construction (LU1)

**Teaching and assessment materials/methods**

Teaching material:

- 40 pages with lecture notes and theory (6-8 pages per topic).
- 7 presentations, one per each topic (3-5 slides per each presentation).
- Case studies: 15.
- FAQs: 25.



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#### Assessment material:

- Multiple choice questions: 25.
- Case studies and application scenarios analysis: 3.

All learning materials will be available in English and in the partnership languages (German, Latvian, Greek, Spanish and Finnish).

#### Planned duration of the learning unit

- Average duration for reading the lecture notes and slide presentations: 20h
- Learner personal work: 6h

#### References

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2. Bejtka I. Cross (CLT) and diagonal (DLT) laminated timber as innovative material for beam elements. KIT Scientific Publishing, 2011., 144 p.
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5. Karacabeyli E., Gagnon S. Canadian CLT Handbook, 2019 Edition. Volume I. National Library of Canada, 2019., 462 p.
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7. Mahamid M. Cross-Laminated Timber Design: Structural Properties, Standards, and Safety. McGraw-Hill Education Ltd. 2020., 368 p.
8. Manual for the design of timber building structures to Eurocode 5. London: TRADA Institution of Structural Engineers, 2007. 258 p.
9. Muraleedharan A. and Reiterer S. M. Combined glued laminated timber using hardwood and softwood lamellas. GRIN Publishing, 2017., 64 p.
10. Rowell R.M. Handbook of wood chemistry and wood composites. London : Taylor&Francis group, London, 2005. 487 p. 4. Timber engineering. Edited by Sven Thelandersson, Hans J. Larsen. Chichester etc.:John Wiley&Son, 2003. 446 p.
11. Timber engineering. Edited by S. Thelandersson, H. J. Larsen. Chichester etc.:John Wiley & Son, 2003. 446 p.
12. Binderholz <https://www.binderholz.com/en-us/>
13. MetsaWood Products  
<https://www.metsawood.com/global/Products/Pages/Products.aspx>
14. MiTek wood truss production <https://www.mii.com/>
15. RothoBlaas connectors and subequipment <https://www.rothoblaas.com/>
16. Stora Enso Massive Wood constructions  
<https://www.storaenso.com/en/products/wood-products/massive-wood-construction>
17. UPM Biocomposites <https://www.upm.com/businesses/upm-biocomposites/>
18. UPM Timber <https://www.upm.com/businesses/upm-timber/>
19. <https://lignumdata.ch/?lang=en>
20. Taschenbuch Holzbau Schweiz
21. <https://www.dataholz.eu/>
22. [www.infoholz.at](http://www.infoholz.at)

#### Notes



Table 4. Learning unit 3 specifications

Learning unit title		
On-site wood construction assembling management / Learning unit 3 (LU3)		
<b>Abstract</b>		
<p>Teamwork, especially at building site must ensure cooperation at all levels, using good practice, be familiar with the methods of construction work, the conditions of their organization and management, the basic principles of technological design of construction (includes timber elements) work. It is important for any builder to know the technological documentation of the project and its circulation on the building site, the latest equipment used in construction works and the sequence of technological processes. It always means to manage tasks of the group involved in direct project and share with information for getting positive result. For full scale timber structures important is the basic principles of thermal, sound insulation and especially fire protection elements and their assembling. LU provides Euro Classification system and regulatory rules in partner countries, as well as composition of the wood materials, from the fire characteristics, thermal, sound characteristic point of view and review opportunities for improvement. All things mentioned above should be taken into consideration as a complex of the requirements related to building physics.</p> <p><b>Objective</b> of this LU3 is to provide the knowledge of the basic principles of the timber material movement on building site, the technological documentation of construction processes and the procedures for drawing up such works, brings to builders the basic knowledge to carry out efficient buildings according thermal, sound insulations, fire protection aspects, as well as transporting and storing of the wood structures on building site. Ability to comply with construction technology in accordance with construction standards in a work with timber structures, as well as to determine basics of the labour safety measures.</p>		
<b>European Qualifications Framework (EQF) Level</b>		
Level 5		
<b>Learning Objectives</b>		
<p><b>Knowledge</b></p> <p><b>Knows/Aware of:</b></p> <ul style="list-style-type: none"> <li>the methods of transportation and storage of wooden building elements on the building site.</li> <li>fire protection, thermal and sound insulation necessity and building physics in the construction process.</li> <li>the rules and standards for insulation and quote techniques, materials and products for water/air tightness.</li> <li>different insulation materials (conventional and environmentally</li> </ul>	<p><b>Skills</b></p> <p><b>Able to:</b></p> <ul style="list-style-type: none"> <li>select and apply appropriate execution methods of construction operations corresponding to building site situation as well as to prepare an execution documents.</li> <li>organize work in accordance with the basic principles of ergonomics and observing requirements of labour safety.</li> <li>choose and apply appropriate technical units and equipment for execution of works with</li> </ul>	<p><b>Competences</b></p> <p><b>Capable to:</b></p> <ul style="list-style-type: none"> <li>organize/prioritize tasks and collaborate with team members.</li> <li>orientate in the regulatory framework of construction industry, particularly regulation set and technical documentation for building site processes.</li> <li>choose appropriate building technology based on technical and economic calculations of rational construction machinery.</li> <li>select appropriate materials and</li> </ul>



friendly) and their implementation.	timber structural elements.	technology derived from the creation of a constructive solution and fire protection point of view. • evaluate the quality of materials.
<b>Topics / Content</b>		
<ul style="list-style-type: none"> <li>• Work planning and team management.</li> <li>• Workspace organization – ergonomic and labour safety.</li> <li>• Guidelines for transporting and storing structures on building site.</li> <li>• Architectural design – drawings and schemes.</li> <li>• Building physics, installing of vapour barrier and risks of the resulting condensation.</li> <li>• Fire safety and protection solutions.</li> <li>• Wood-based thermal and sound insulation in assembling process.</li> </ul>		
<b>Prerequisites / recommended background</b>		
UPWOOD Learning unit 2 - Timber construction, renovation and deconstruction (LU2)		
<b>Teaching and assessment materials/methods</b>		
<p>Teaching material:</p> <ul style="list-style-type: none"> <li>• 40 pages with lecture notes and theory (5-7 pages per topic).</li> <li>• 7 presentations, one per each topic (3-5 slides each presentation).</li> <li>• Case studies: 15.</li> <li>• FAQs: 25.</li> </ul> <p>Assessment material:</p> <ul style="list-style-type: none"> <li>• Multiple choice questions: 25.</li> <li>• Case studies and application scenarios analysis: 3.</li> </ul> <p>All learning materials will be available in English and in the partnership languages (German, Latvian, Greek, Spanish and Finnish).</p>		
<b>Planned duration of the learning unit</b>		
<ul style="list-style-type: none"> <li>• Average duration for reading the lecture notes and slide presentations: 10h</li> <li>• Learner personal work: 10h</li> </ul>		
<b>References</b>		
<ol style="list-style-type: none"> <li>1. Babrauskas V. Ignition Handbook. Issaquah WA: Fire science publishers, 2003. 1116 p.</li> <li>2. Brändsäkra trähus 3, Fire safe use of wood, Nordic-Baltic State of the art and guidance. SP Technical Research Institute of Sweden. SP Report 2012:18, 2012. 179 p ISBN 978-91-87017-32-2.</li> <li>3. Fire safety in timber buildings, technical guideline for Europe. SP Technical Research Institute of Sweden. SP Report 2010:19.. 2010. 211 p. ISBN 978-91-86319-60-1. Aviable at: <a href="http://eurocodes.jrc.ec.europa.eu/doc/Fire_Timber_Ch_5-7.pdf">http://eurocodes.jrc.ec.europa.eu/doc/Fire_Timber_Ch_5-7.pdf</a></li> <li>4. Gupta, Ram S. Principles of Structural Design: Wood, Steel, and Concrete, Third Edition. Taylor &amp; Francis Ltd; 3 New edition edition, 2019., 599 p.</li> <li>5. Hummel J. Displacement-based seismic design for multi-storey cross laminated timber buildings (Schriftenreihe Bauwerkserhaltung und Holzbau). Kassel University Press, 2017., 207 p.</li> </ol>		





<p>6. Purkiss J.A. Fire safety engineering design of structure. Oxford: Elsevier Ltd, 2007. 389 p.</p> <p>7. Stazi F. Thermal Inertia in Energy Efficient Building Envelopes. Butterworth-Heinemann, 2017., 374 p.</p>
<b>Notes</b>

Table 5. Learning unit 4 specifications

Learning unit title		
Functionality and efficiency of wooden buildings / Learning unit 4 (LU4)		
<b>Abstract</b>		
<p>Long service life of timber structures requires good design, moisture safety during construction and good maintenance. And when the wooden parts are no longer used in buildings, they have the potential to be recycled into other products – so the atmospheric carbon stays locked away. After a cascade of recycling, wood material can be used for bioenergy production. Construction sector can make a real difference by using wooden construction materials that both capture carbon for their entire life span as well as are produced with very little CO<sub>2</sub> emissions during production. Wood-based materials can be used in most parts of any building to capture carbon from the atmosphere. This allows designers and builders to reach ambitious CO<sub>2</sub> reduction goals. Wooden building components store carbon in all buildings regardless of their frame, insulation and cladding materials. The largest potential for storing carbon can be achieved in external walls, intermediate floors and roof structures. Over the past century many European countries conducted a study and design of a comprehensive review of operational experience have resulted in building basic design principles. Energy-efficiency should be all new buildings and wood structures have great opportunities in this case. At the same time must pay attention to climate influence for this structures and could be done by right creation of drywall construction, sealing, as well as heating, ventilation, air conditioning systems.</p> <p><b>Objective of this LU4</b> to learn the best choice to use timber and wooden materials for buildings in an energy-efficiency way, to reduce possibilities of global climate changes, get wider knowledge and skills for plumbing, drywall construction, sealing, as well as insight to heating, ventilation, air conditioning, lighting, information and communications technology systems and its applications in modern buildings, in which mostly timber as building material are used.</p>		
<b>European Qualifications Framework (EQF) Level</b>		
Level 5		
<b>Learning Objectives</b>		
<p><b><u>Knowledge</u></b></p> <p><b><u>Knows/Aware of:</u></b></p> <ul style="list-style-type: none"> <li>the benefits of using wood in the active and passive design of a building in terms of energy efficiency.</li> <li>best performance wood materials for</li> </ul>	<p><b><u>Skills</u></b></p> <p><b><u>Able to:</u></b></p> <ul style="list-style-type: none"> <li>integrate technical building components in timber construction.</li> <li>do step by step processes for plumbing, drywall construction, sealing creation.</li> </ul>	<p><b><u>Competences</u></b></p> <p><b><u>Capable to:</u></b></p> <ul style="list-style-type: none"> <li>find the best ecological and economically advantageous, as well as a correlation in terms of suitable wood design solutions.</li> <li>evaluate the climate influence on wooden</li> </ul>



<p>direct application in structures.</p>		<p>buildings in order to reduce energy consumption.</p> <ul style="list-style-type: none"> <li>• choose best way to heat, ventilate, cooling, lighting, provide information communications technologies system for timber constructions.</li> </ul>
<p><b>Topics / Content</b></p>		
<ul style="list-style-type: none"> <li>• Energy-efficiency value of wood as a building material and wooden constructions.</li> <li>• Climate influence on wooden buildings.</li> <li>• Trainings for plumbing, drywall construction, sealing.</li> <li>• Insight to heating, ventilation, air conditioning, lighting, information and communications technologies systems and its applications in modern buildings.</li> </ul>		
<p><b>Prerequisites / recommended background</b></p>		
<p>UPWOOD Learning unit 3 - On-site wood construction assembling management (LU3)</p>		
<p><b>Teaching and assessment materials/methods</b></p>		
<p>Teaching material:</p> <ul style="list-style-type: none"> <li>• 40 pages with lecture notes and theory (10 pages per topic).</li> <li>• 4 presentations, one per each topic (5-7 slides each presentation).</li> <li>• Case studies: 15.</li> <li>• FAQs: 25.</li> </ul> <p>Assessment material:</p> <ul style="list-style-type: none"> <li>• Multiple choice questions: 25.</li> <li>• Case studies and application scenarios analysis: 2.</li> </ul> <p>All learning materials will be available in English and in the partnership languages (German, Latvian, Greek, Spanish and Finnish).</p>		
<p><b>Planned duration of the learning unit</b></p>		
<ul style="list-style-type: none"> <li>• Average duration for reading the lecture notes and slide presentations: 4h</li> <li>• Learner personal work: 10h</li> </ul>		
<p><b>References</b></p>		
<ol style="list-style-type: none"> <li>1. Aicher S., Reinhardt H.-W., Garrecht H. Materials and Joints in Timber Structures: Recent Developments of Technology. Springer; 2014., 855 p.</li> <li>2. Energy efficiency and building with wood <a href="https://www.constructionspecifier.com/energy-efficiency-and-building-with-wood/">https://www.constructionspecifier.com/energy-efficiency-and-building-with-wood/</a></li> <li>3. HolzBauForum <a href="https://www.forum-holzbau.com/">https://www.forum-holzbau.com/</a></li> <li>4. Using wood is one of the best solutions for energy shortage <a href="https://www.europeanwood.org.cn/en/energy-efficiency">https://www.europeanwood.org.cn/en/energy-efficiency</a></li> <li>5. Thermal insulation &amp; energy efficiency <a href="https://www.petermueller.be/wood-frame-construction-arguments/insulation/">https://www.petermueller.be/wood-frame-construction-arguments/insulation/</a></li> <li>6. Wasserkabel heating and cooling systems – <a href="https://www.wasserkabel.eu/?page_id=748&amp;lang=lv">https://www.wasserkabel.eu/?page_id=748&amp;lang=lv</a></li> <li>7. Wood: A Good Choice for Energy Efficiency and the Environment <a href="https://www.forestfoundation.org/wood--a-good-choice-for-energy-efficiency-and-the-environment">https://www.forestfoundation.org/wood--a-good-choice-for-energy-efficiency-and-the-environment</a></li> </ol>		



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<b>Notes</b>



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## 5. References

- [1] CEDEFOP (2011). The European Credit System for Vocational Education and Training ECVET: Get to know ECVET better Q&A. Lifelong learning: Policies and Programme – [https://www.cedefop.europa.eu/files/ECVET\\_QUESTION\\_ANSWERS\\_Feb\\_2011\\_en\(download\\_ID\\_17648\).pdf](https://www.cedefop.europa.eu/files/ECVET_QUESTION_ANSWERS_Feb_2011_en(download_ID_17648).pdf)
- [2] The European Qualification Framework – [http://ecahe.eu/w/index.php/European\\_Qualifications\\_Framework](http://ecahe.eu/w/index.php/European_Qualifications_Framework)